REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION	1b. RESTRICTIVE MARKINGS
Unclassified	--

2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT
--	Approved for public release; distribution is unlimited.
2b. DECLASSIF --	

AD-A227 718

4. PERFORMIN --	5. MONITORING ORGANIZATION REPORT NUMBER(S)
	ARI Research Note 90-129

6a. NAME OF PERFORMING ORGANIZATION	1BOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
Dr. Philip H. Marshall	--	U.S. Army Research Institute Field Unit at Fort Huachuca

6c. ADDRESS (City, State, and ZIP Code)	7b. ADDRESS (City, State, and ZIP Code)
Department of Psychology Texas Tech University Lubbock, TX 79409	ATTN: PERI-SA Ft. Huachuca, AZ 85613-7000

8a. NAME OF FUNDING/SPONSORING ORGANIZATION U.S. Army Research Institute for the Behavioral and Social Sciences	8b. OFFICE SYMBOL (If applicable) PERI-S	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DAAL 03-86-D-0001

8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS			
	PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO. (148)	WORK UNIT ACCESSION NO.
5001 Eisenhower Avenue Alexandria, VA 22333-5600	63007A	793	1306	H01

11. TITLE (Include Security Classification)
Review of High Memory Demand Courses in the Military Intelligence Officer BASIC Course (MIOBC): A Case Study

12. PERSONAL AUTHOR(S)
Marshall, Philip H. (Texas Tech University)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM 89/06 TO 89/10	1990, September	26

16. SUPPLEMENTARY NOTATION
Technically monitored by Contracting Officer's Representative Beverly G. Knapp, ARI Field Unit at Fort Huachuca

17.	COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Intelligence training , Course evaluation.
			Officer training
			Computer-assisted instruction

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

For this report, researchers evaluated the training procedures used in the "Soviet Threat" component of the Military Intelligence Officer Basic Course at the U.S. Army Intelligence Center and School. Statistical analyses revealed difficulties with certain components of that course, and also confirmed that performance in this block of instruction was inferior to other blocks in that course. Based on these analyses and interviews and survey data, it was recommended that learning aids be developed, a laboratory section be added, and that a computerized tutorial system be developed. Such a system would not only benefit the immediate acquisition and retention of information, but would also serve as a remedial resource as students progress through the course.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
Beverly G. Knapp	(602) 538-4704	PERI-SA

DD Form 1473, JUN 86   *Previous editions are obsolete.*   SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

Review of High Memory Demand Courses in the Military Intelligence Officer Basic Course (MIOBC): A Case Study

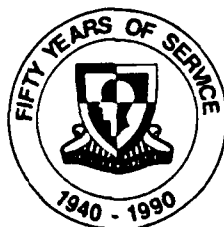Philip H. Marshall

Texas Tech University

for

Contracting Officer's Representative
Beverly G. Knapp

Field Unit at Fort Huachuca, Arizona
Julie A. Hopson, Chief

Systems Research Laboratory
Robin L. Keesee, Director

September 1990

90 10 1 001

United States Army
Research Institute for the Behavioral and Social Sciences

U.S. ARMY RESEARCH INSTITUTE
FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency Under the Jurisdiction
of the Deputy Chief of Staff for Personnel

EDGAR M. JOHNSON
Technical Director

JON W. BLADES
COL, IN
Commanding

NOTICES

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION	1b. RESTRICTIVE MARKINGS
Unclassified	--

2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT
--	Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
--	

4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
--	ARI Research Note 90-129

6a. NAME OF PERFORMING ORGANIZATION	6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
Dr. Philip H. Marshall	--	U.S. Army Research Institute Field Unit at Fort Huachuca

6c. ADDRESS (City, State, and ZIP Code)	7b. ADDRESS (City, State, and ZIP Code)
Department of Psychology Texas Tech University Lubbock, TX 79409	ATTN: PERI-SA Ft. Huachuca, AZ 85613-7000

8a. NAME OF FUNDING/SPONSORING ORGANIZATION U.S. Army Research Institute for the Behavioral and Social Sciences	8b. OFFICE SYMBOL (If applicable) PERI-S	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DAAL 03-86-D-0001

8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS			
	PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO. (148)	WORK UNIT ACCESSION NO.
5001 Eisenhower Avenue Alexandria, VA 22333-5600	63007A	793	1306	H01

11. TITLE (Include Security Classification)
Review of High Memory Demand Courses in the Military Intelligence Officer BASIC Course (MIOBC): A Case Study

12. PERSONAL AUTHOR(S)
Marshall, Philip H. (Texas Tech University)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM 89/06 TO 89/10	1990, September	26

16. SUPPLEMENTARY NOTATION
Technically monitored by Contracting Officer's Representative Beverly G. Knapp, ARI Field Unit at Fort Huachuca

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Intelligence training Course evaluation
			Officer training
			Computer-assisted instruction

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

For this report, researchers evaluated the training procedures used in the "Soviet Threat" component of the Military Intelligence Officer Basic Course at the U.S. Army Intelligence Center and School. Statistical analyses revealed difficulties with certain components of that course, and also confirmed that performance in this block of instruction was inferior to other blocks in that course. Based on these analyses and interviews and survey data, it was recommended that learning aids be developed, a laboratory section be added, and that a computerized tutorial system be developed. Such a system would not only benefit the immediate acquisition and retention of information, but would also serve as a remedial resource as students progress through the course.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
Beverly G. Knapp	(602) 538-4704	PERI-SA

DD Form 1473, JUN 86   *Previous editions are obsolete.*   SECURITY CLASSIFICATION OF THIS PAGE

REVIEW OF HIGH MEMORY DEMAND COURSES IN THE MILITARY INTELLIGENCE
OFFICER BASIC COURSE (MIOBC):   A CASE STUDY

CONTENTS

LIST OF FIGURES

REVIEW OF HIGH MEMORY DEMAND COURSES IN THE MILITARY INTELLIGENCE OFFICER BASIC COURSE (MIOBC): A CASE STUDY

Introduction

For the past couple of years, the instructors of the "threat" block have suggested to ARI, Fort Huachuca Field Unit that they provide some assistance with problems observed in that block, notably, the large number of Criterion Action Elements (CAE) "drops" that students experience.

For some time the Military Intelligence Officer Basic Course (MIOBC) "threat" block has presented difficulties in terms of the large amount of material that needs to be learned in a relatively short period of time. The difficulties are manifest in the inordinately large number of students who have to retake examinations over more than a couple of CAEs, the not infrequent "recycling" that occurs, and in the reported retention problems that students have when they proceed to other blocks of the OBC course, notably, Intelligence Preparation of the Battlefield (IPB), Processing, and War Exercise (WAREX). The most salient feature, given the short duration of the course, would seem to be the need for a more efficient procedure for the rapid acquisition and storage of the substantial amount of material contained in the course.

Preliminary discussions with the instructors suggested that students were just not studying for the course, and that some had a cavalier attitude towards the course. There were no hard data to substantiate that claim. Neither were there systematic data on other aspects of students' performance in the block, nor in the relative difficulties encountered in subsequent blocks. The "threat" block is considered an _enabling_ task, providing an essential basic foundation for subsequent success in other blocks of the OBC course, and it was considered appropriate to conduct an examination along several dimensions. This report details the findings from this examination.

Method

Several aspects of student performance were evaluated. These included:

1. Statistical analysis of nine classes of OBC students, yielding an analysis of the performance of 316 students.

2. Comparison data on a smaller sample (n=106) of students on their performance in IPB and Processing.

3. Questionnaire data from Class 89-11.

4. Observation of course lectures and exercises.

5. Discussions with course instructors and ARI colleagues.

Results

Statistical Analysis

For the purpose of statistical analyses, grade matrix data were collected on nine classes of OBC students. Class size varied from 27 to 44 students, and except for the occasional recycled student and reservist who had some prior knowledge of "threat" related material, all students were naive about the content of the block.

The first analysis had as its purpose the quantification of the actual state of affairs vis a vis success in the block. The basic datum considered was the initial CAE pass rate in the course (initial rate was chosen as the major indicator since ultimate passing of dropped CAEs is virtually "guaranteed" by the retesting procedures of the block), and this was further broken down into the success for each particular CAE (there are 12 altogether) in the block. Figure 1 shows the results of that analysis. There is some variation due to the individual classes. These differences were subjected to an analysis of variance in which CAEs were considered "subjects" (n=12). The results of that analysis yielded a significant difference among classes, F= 3.71, p < .01.

It was considered that the variation in class performance may have been due to class size or the quality of instruction in the course, since instructors are rotated through. A correlational analysis between class size and overall mean passing rate for the nine classes, however, yielded r= -.38, p > .05, an insignificant relationship. To assess the possible contribution that instructor differences may have had, the mean performance for the combined classes of each of the instructors was obtained. There were only two instructors for the nine classes. Instructor A's classes had a mean passing rate of 77.09 (sd = 5.17), and Instructor B's classes had a rate of 80.26 (sd = 5.77). It is reasonable to conclude that neither class size nor instructor differences account for class performance differences. Further, to whatever these differences may be attributed, the actual per class pass rate on CAEs overall varied between 71.52 and 88.27 percent (mean = 79.21, sd = 5.48). The former value is very low, and the latter value is not that high, so all classes may be considered to have experienced difficulty, and the remaining analyses consider aggregate data for the nine classes (n=316 students).

The average performance, then, over all nine classes is depicted in Figure 2 in which the average percentage of students passing each
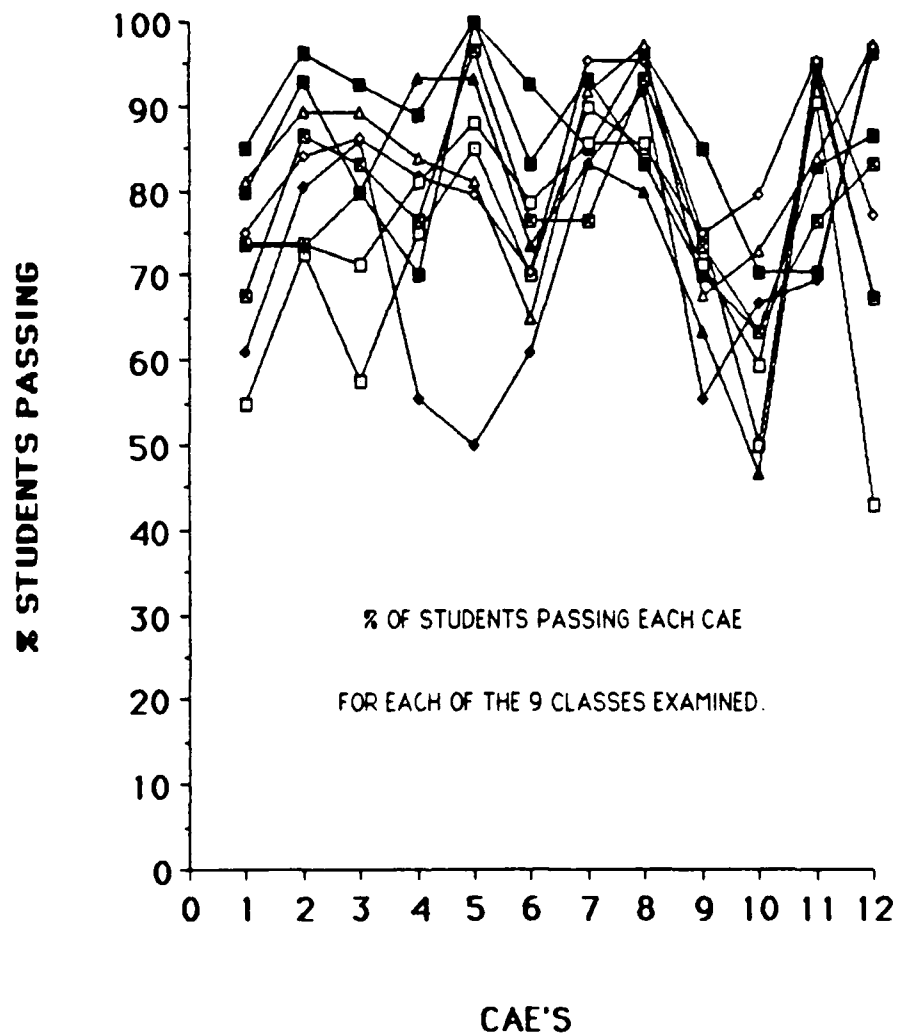
% OF STUDENTS PASSING EACH CAE

FOR EACH OF THE 9 CLASSES EXAMINED.

Figure 1. Percent of students passing each CAE for each of nine
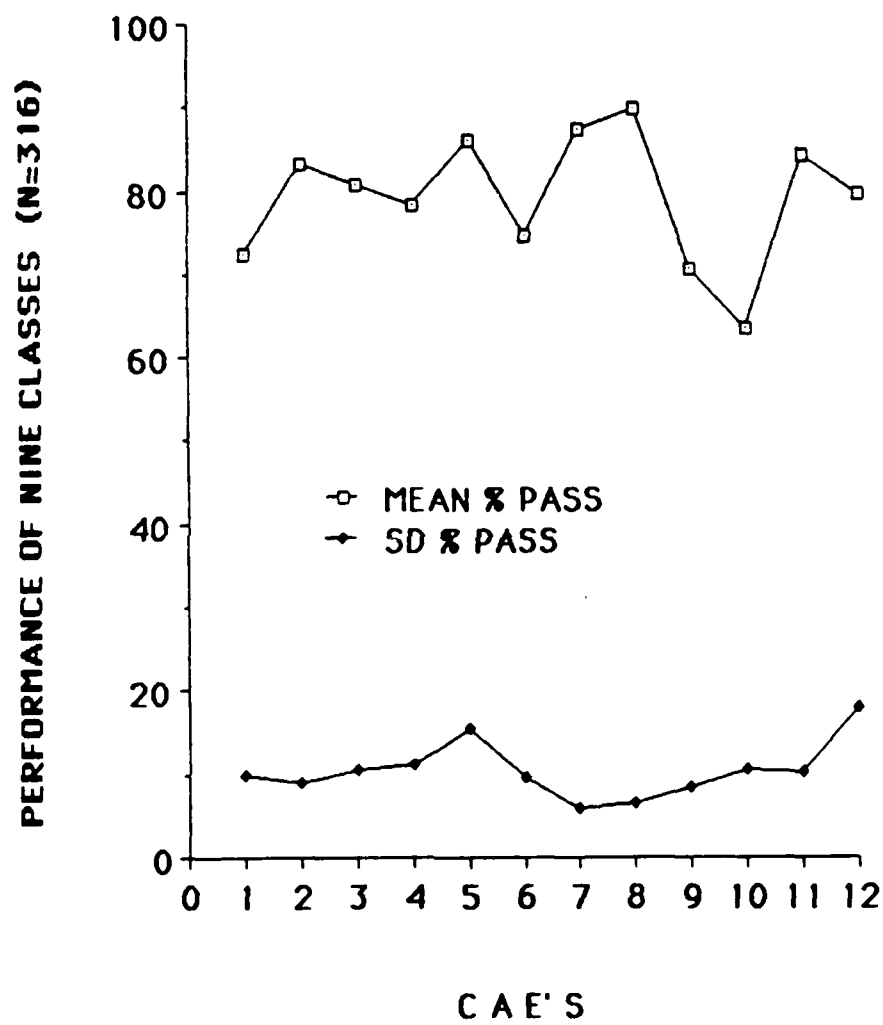classes.

3

Figure 2. Average number of students passing each CAE.

of the CAEs is given, along with the standard deviation of those means. The major conclusion to be drawn from these data is that some CAEs are consistently passed at a higher level than others. At the extremes, CAEs 7 and 8 (representing "offense") have the highest overall pass rate, with the least accompanying variability, whereas CAE 10 ("airborne") has the lowest overall pass rate, and a moderate level of between classes variability.

To get a different look at class performance, an analysis was performed on the number of students that proceeded through the block having dropped "n" number of CAEs. Figure 3 presents these data in terms of both absolute number of CAEs dropped, and in percent. Inspection of Figure 3 shows that a surprising number of students in the overall sample (at least to one veteran instructor) made it through the block without dropping any CAEs (95 students, or roughly 30%), although success drops off steadily thereafter.

It was then of interest to determine how badly missed dropped CAEs actually were. Figure 4 presents these data. The data in Figure 4 are depicted in terms of both the mean actual number of criterion points by which a given CAE was dropped, and more informatively, because the criterion point values vary among the CAEs, the mean percentage of the criterion score by which a CAE was dropped. For the latter, dropped CAEs missed the criterion score by an average of about 24% of the criterion score, or about 18% of the maximum score (of necessity this value is lower since maximum point value is higher than criterion point value). Thus, while the average number of points by which a CAE was dropped remained relatively constant at about two points, this value takes on a greater weight for CAEs having lower point values.

In fact, since the criterion point values per CAE vary between 5 and 15 (maximum point values between 7 and 21) an analysis was performed to determine if there was a significant correlation between the number of test items in the CAEs and the percentage of students passing each CAE. The value of that correlation was $r=.21$, $p > .50$, an insignificant relationship.

The mean criterion passing percentage required for each CAE varied between 71 and 78 percent (mean = 74.58, sd = 2.94), in each instance slightly higher than the doctrinal level of 70%. There was not a significant correlation between the mean passing level of CAE and its associated criterion passing percentage, $r= -.48$, $p > .10$, although the direction, at least, of this relationship is consistent with the fact that higher criterion percentages may be related to lower passing rates (not a surprising outcome).

There are two examinations in this block. The first covers five CAEs and the second covers seven CAEs. Does performance differ over the two examinations? To answer this question, the percentage of total course CAEs that were dropped was considered vis a vis the
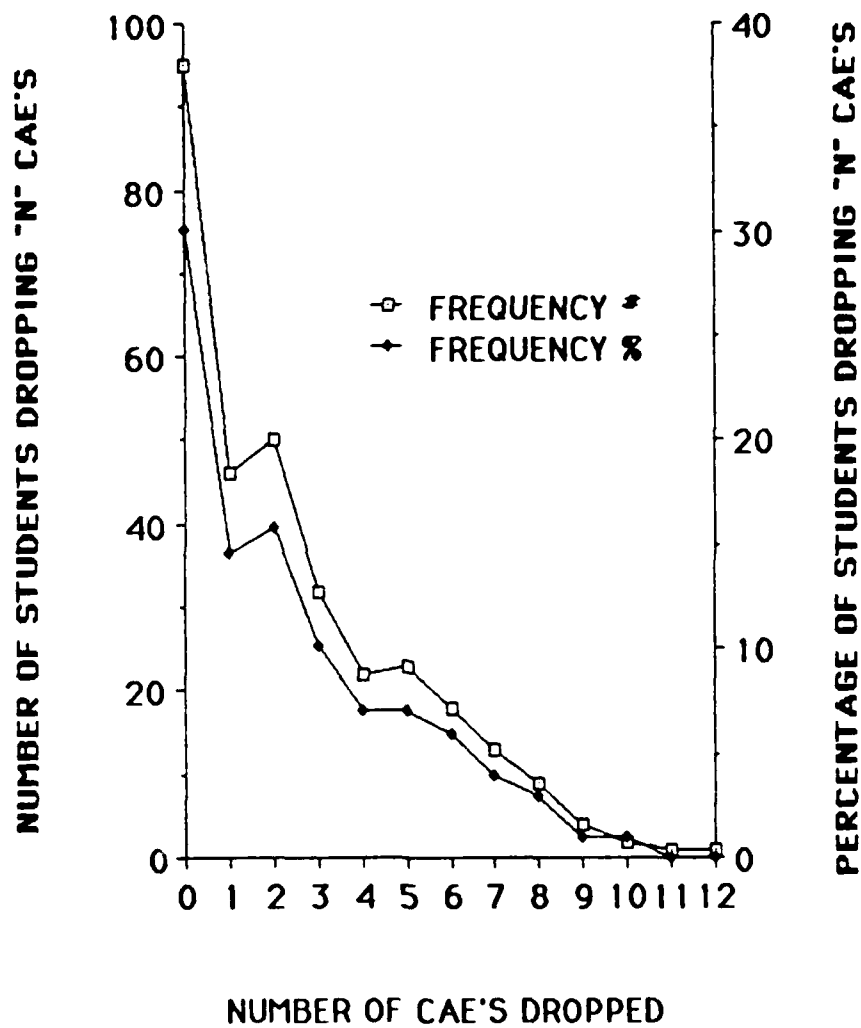
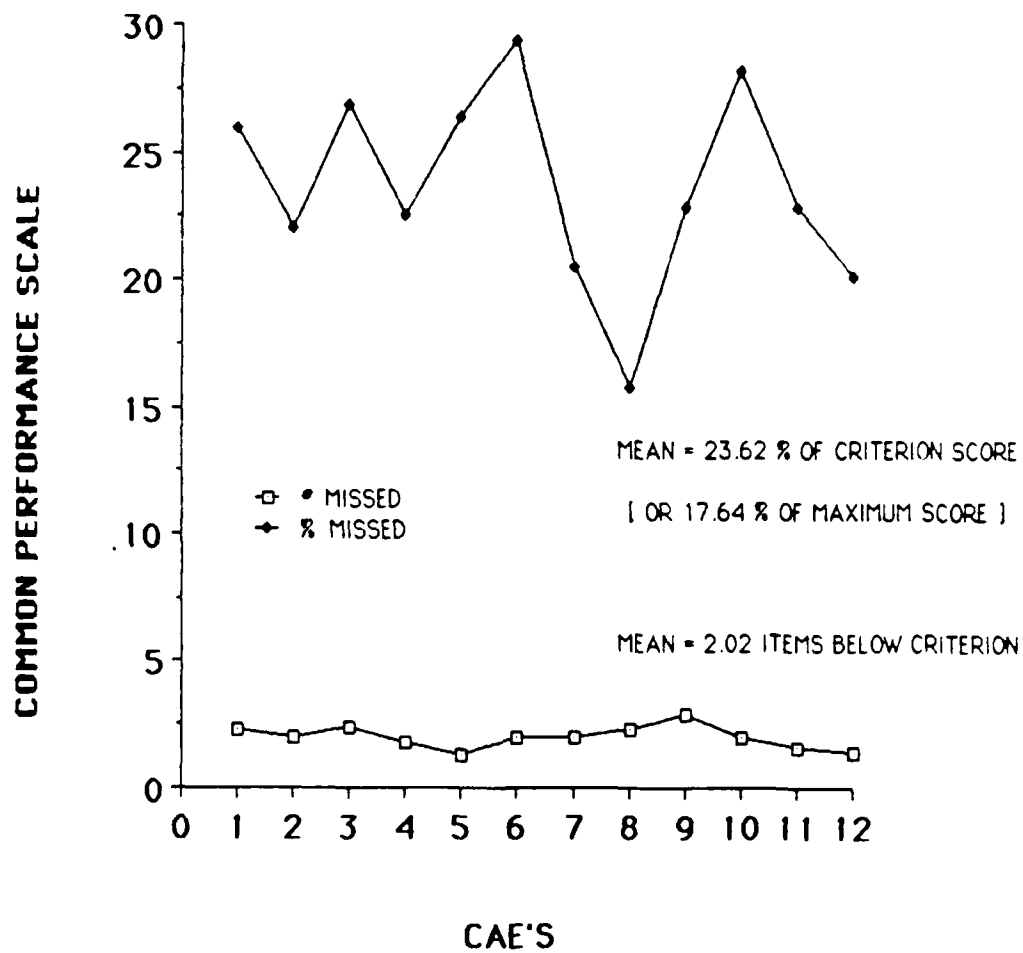Figure 3.   CAE pass rate in relation to CAEs dropped.

Figure 4. Criterion points missed related to dropped CAEs.

expected number of CAEs to be dropped per examination. It was established that for an unbiased estimate 5/12 (42%) of CAEs should have been dropped on the first examination, and 7/12 (58%) should have been dropped on the second examination. The actual obtained values were very close, 39% and 61%, respectively. So class performance remained "even" over the two examinations (see Figure 5).

Comparison Data

Since anecdotal information about students' poor performance in the "threat" block was the impetus for this study, a comparison was made between "threat" performance, and that for IPB and Processing. (IPB and Processing are the courses requiring cognitive utilization of threat, as well as other material). For this comparison, data from three classes was available (total n=106 students). Figure 6 presents the mean (and sd) percentage of students passing each CAE for both IPB and Processing, and Figure 7 shows mean percent passing each CAE for all three blocks. Performance in IPB seems to be higher than performance in Processing (the reasons need to be left to another analysis), and the anecdotal information was correct, at least in part. Performance in "threat" is, overall, inferior to performance in IPB and Processing for these three classes.

Questionnaire Data

Class 89-11 was surveyed with a questionnaire designed to determine their feelings about various aspects of the "threat" block as now in place, and about some possible modifications that might be made (these changes will be addressed in the Recommendations Section of this report). Out of the approximately 30 students in that class, 12 responded to the questionnaire, and only one student volunteered for a personal interview (subsequently cancelled). These data must therefore be considered only suggestive at best.

Most of the questions asked for students to respond with the following seven point scale:

```
Not at all                                    Very Much
    1       2       3       4       5       6       7
```

The results are summarized as follows with numbers in parentheses being average response values:

1. Students found their own class notes (6.25) and lecture outlines (6.58) to be more valuable than the course manuals (3.33) in preparing for the examinations.

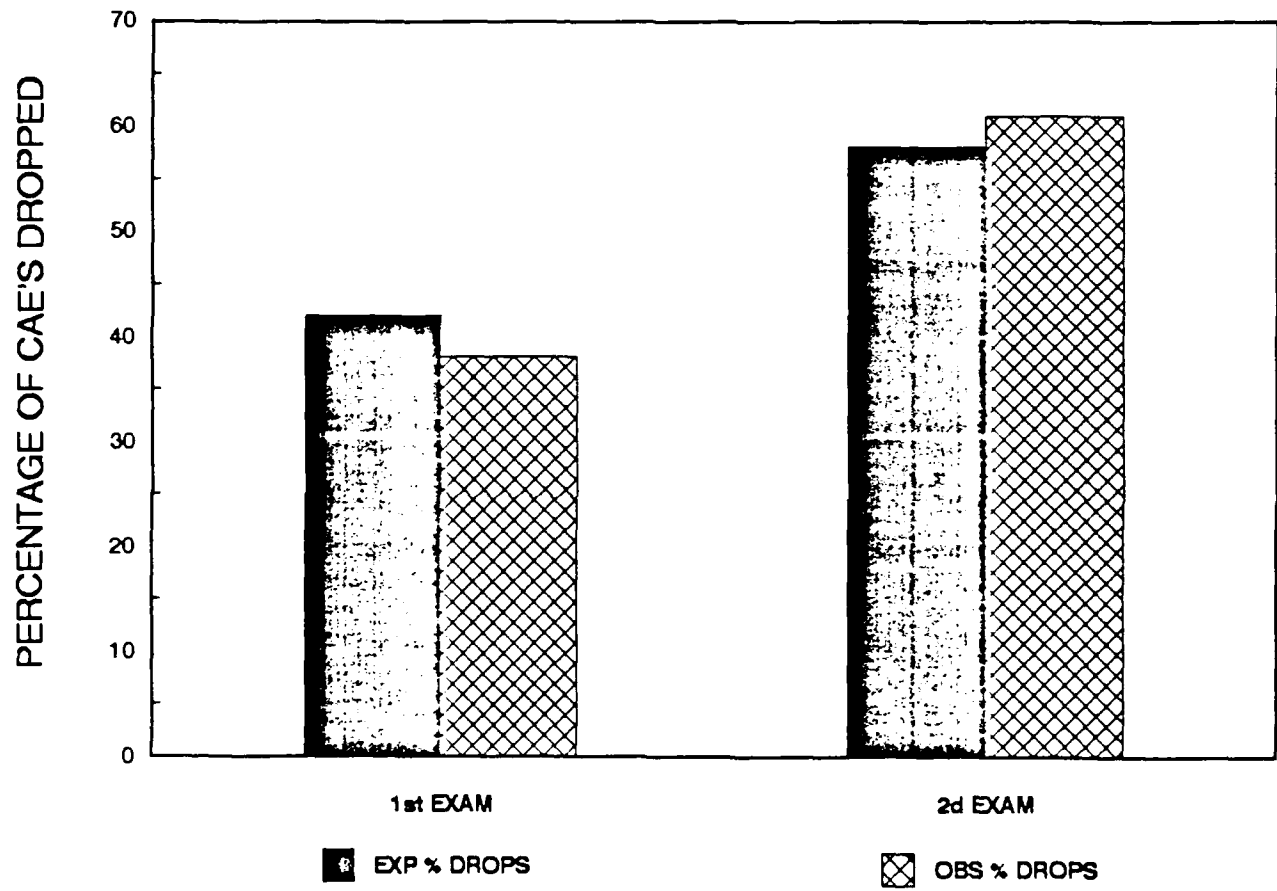2. Those who participated in study groups (8 out of 12) found them to be moderately valuable (5.00).

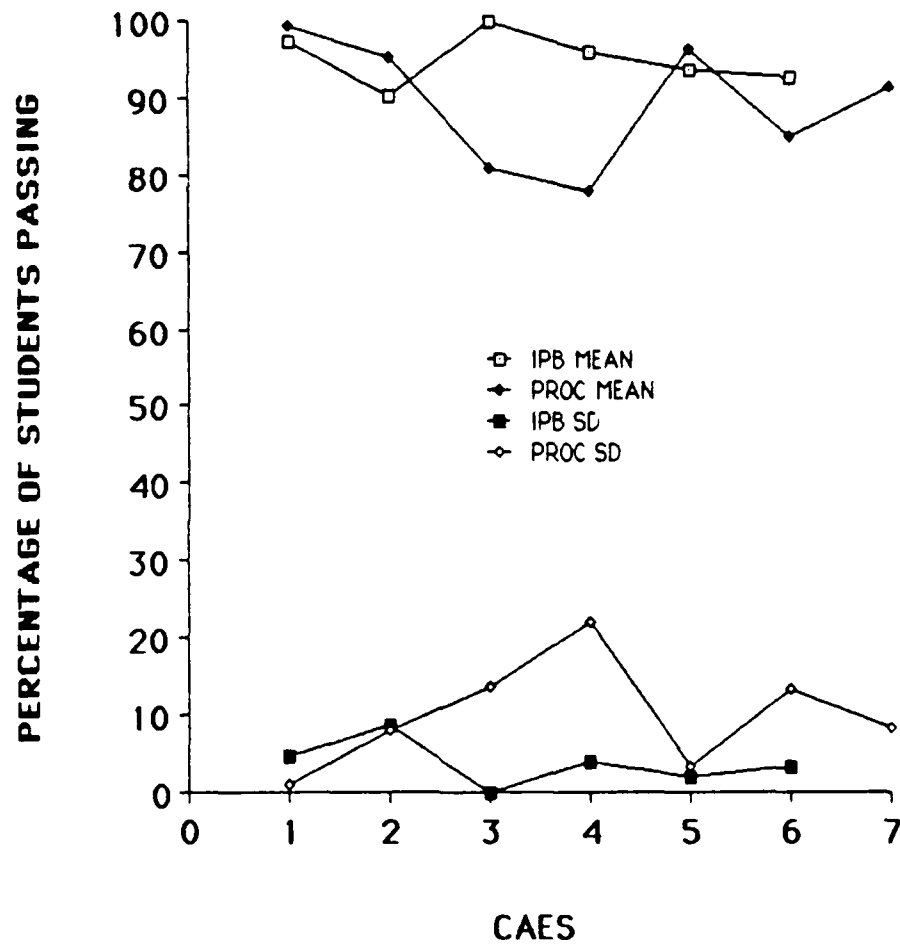Figure 5.   Expected vs observed CAEs dropped by exams.

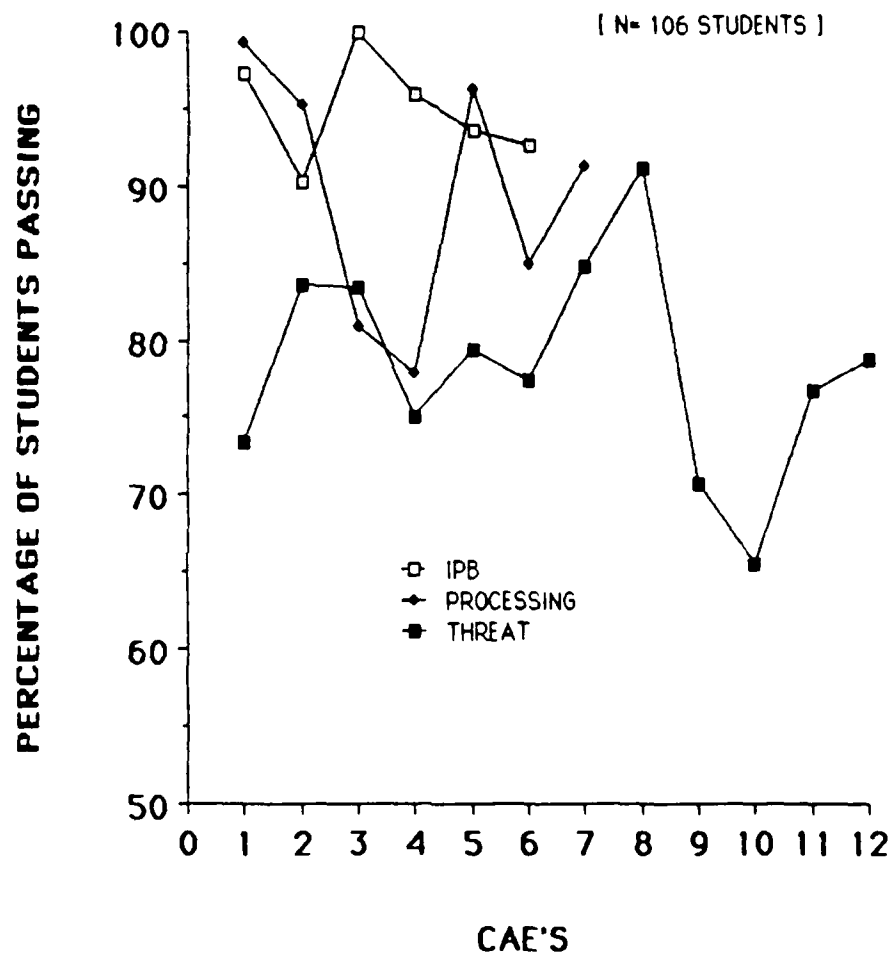Figure 6.   CAE pass rates for IPB and processing course blocks.

Figure 7. CAE pass rate comparison for IPB, processing, and threat.

11

3. Students would have preferred an examination over a CAE as soon as they had mastered the material (5.33).

4. At a moderate level, they would have preferred personal evaluations of subject matter mastery (4.83).

5. Realistic models of Soviet equipment and the opportunity to manipulate them into various configurations and battlefield scenarios would have been a helpful exercise for organizing and conceptualizing the material they had to learn (5.82).

6. Of those that have used computerized instructorial modules, students thought they would be helpful (5.33).

For the record, two of the students thought that nothing would have helped, giving "1's" for most of their responses.

Observation of Course Lectures and Exercises

The investigator had the opportunity to observe several lectures over the course material and to observe the final WAREX exercises. Lectures are preceded by the handing out of lecture outlines, some of which are in some detail. The lectures that were observed were accompanied with graphic representations, and the atmosphere in the lectures was open and interactive. There was ample opportunity for student questions, and student attention was at a high level since some were called upon, on a random basis, to answer questions.

The material as presented in the instructional manuals is essentially verbal in nature. The presentation of the organization and equipment matrices is, of necessity, complex. The pictorial presentations are so poorly reproduced as to yield little or no visual memory for what they represent. Thus, virtually the whole of what the students have encoded is verbal in nature. They have only a limited concept of what the symbology represents, or what the equipment looks like. In essence, they have memorized by rote the facts of the material, but still do not have a personal, multi-modal organizational or representational system for that information.

The WAREX exercise was particularly illuminating since it represents what the "final product" of the OBC is supposed to be, it was observed that the students had some difficulty responding to questions concerning Soviet threat matters. It was also apparent that the colonel taking the briefing placed major importance on intelligence officers being able to have such information readily available.

From the beginning, this observer was impressed by the lack of any sophisticated, contemporary instructional technology being used in the "threat" block. What instructional materials there are

12

consist of mimeographed handouts prepared by the instructors. The instructional delivery system is generations behind the material the students are supposed to be learning about. On the other hand, there have been a couple of instruments that by one means or another have been developed for instructional purposes that parallel the objectives of the "threat" block.

Several years ago, a series of computer programs called "Think Red" was developed that was to represent in graphic form Soviet doctrine. As far as could be ascertained that material was never fully introduced into the "threat" course, nor was there ever an evaluation of the effectiveness of it as an instructional aid. The ARI-Ft. Huachuca Field Unit did present an evaluation of "Think Red" in terms of its compatibility with contemporary cognitive theory (Hall & Knapp, 1983), however, that program is obsolete. Also, there is a current, developing Apple Macintosh program called "Red Star" (Science Applications International Corporation (SAIC)) that attempts to present Soviet doctrine, but it is uncertain as to what the disposition of that program will be. (Also, it's on a non-compatible software format).

Discussions with Course Instructors and ARI Colleagues

The purpose of these discussions was to get some idea of how the course has developed and what attempts have been made in that history to improve the final product.

Several points are worth noting:

1. The course instructors are functionally the primary determiners of what the specific content of the course will be, how it will be taught, and what resource material will be available to the students. Although there is a course manager, the function of that office seems to be mostly administrative in nature, in order to perform quality control functions.

2. The instructors are well motivated and well meaning, although having to frequently rotate through new classes would seem to leave little time for the development of personal concerns for an individual student. On the other hand, it must be noted that all instructors note that they are paid for "24 hours work," and are available to the students when they need the help. Unfortunately, students are probably reluctant to bother the instructors on evenings and on the weekend--times when the students are presumably doing their most intensive studying. Not having course resources available during these times is particularly disadvantageous considering the short duration of the block.

3. The instructors have made several attempts on their own to improve the quality of instruction and to promote better acquisition of the course material. They have prepared detailed lecture outlines, developed "pop quizzes," and have tried to see that all

13

material on the examinations has been covered explicitly during the lectures. However, some coverage has to be left out by virtue of the amount of time available for lectures. Anecdotally, it was observed from the WAREX briefing that when the range of certain weapons was requested, an observing "threat" instructor said to students standing by, "I told you that you would have to know the range of that eventually." Obviously, then, in picking and choosing among essential information during "threat" instruction, some material had to be left out. Indeed, that information is in the manual, but according to questionnaire data, students tend to spend little time with the manual per se.

4. The instructors have been successful in securing a recent increase in the number of hours devoted to "threat" instruction, although they cannot point to that having a noticeable increase in student performance.

5. The current instructors have been at their assignments for at least several years. There is no scheduled activity by which their own knowledge of "threat" related information is up-dated. They attempt to keep abreast by informal contacts with field units, and reading documents which they are able to obtain on their own. The current frequency of turnover of instructors is not sufficient to allow for "new blood" in the system. They would welcome the opportunity to have more contact with the greater active MI community.

6. This OBC course, as currently structured and administered through channels, not only allows for automatic re-examinations, but virtually guarantees that students will eventually pass (nearly all, but there are some exceptions). It would not be difficult to document instances of students taking examinations over particular CAEs up to six or more times. In fact, one former instructor considered that some students may view the initial examination as just practice, knowing full well that they will eventually pass. This is particularly troublesome since CAEs dropped on the second and last exam, will have to be made up while the students have proceeded to the next part of the course. Thus, the student is in the position of having to double up on studies, and so optimizing learning of both subjects is in jeopardy.

Recommendations

The strategy of this course analysis has been multidimensional, and so the recommendations that follow will address several different aspects of the course. These recommendations make the assumption that course content and duration are relatively fixed. The recommendations are not in order of priority.

The instructors need to have the opportunity to be systematically kept abreast of developments in the MI community. There are a couple of ways to accomplish this. It would help to keep in mind that "threat" is viewed as an enabling task, and as a critical task, and so it does not have a front-end analysis of course content. Materials for the course are developed using historical precedence, personal concern for updating of content, and well-intentioned consensus.

It would be useful to conduct a written survey of MI Captains entering Ft. Leavenworth's Combined Arms Services Staff School (CAS3). These officers will have had more than one tour, and will be able to offer valuable guidelines to be used in the development of essential course content, as well as providing valuable field information for the instructors. Another way to accomplish this objective would be for the current instructors to be able to tour, inspect, and observe selected active MI units, or attend threat training at Ft. Leavenworth and the DIA.

One of the most useful handouts that has been prepared for the students is a single page summary of the Soviet military organization, and the type of equipment to be found at each level. This handout should be expanded into a nearly complete description of the content of the "threat" block. All college students are familiar with the laminated sheets that can be purchased which show, for example, everything you might need to know about calculus. Carefully prepared (color coded, etc.) such a tool would be a valuable memory aid and reference instrument for continued use (until upgrading was required). One side could consist of weapons information, and the other would consist of organization and offensive and defensive doctrine. Upgrading from time to time would pose little problem for the word-processed package. Having had such a tool would have facilitated the mad scramble through the manuals that occurred during a WAREX exercise when the colonel asked for the range information. This instrument would also serve to organize the most essential information for the student. It is very common for individual students to prepare similarly conceived instruments for their own study, but one carefully thought out by SMEs would likely be superior and more useful. Prototype products exist, such as the one called S-2 Miltra Field Aid, but it costs $40.00 per copy.

The students do not come to "know" what they are learning about. The simple verbal descriptions do not yield a satisfactory memory representation. This observation is not limited to the "threat" block of instruction. A former instructor in IPB and Processing was looking into the possibility of having simple plywood mock-ups of Soviet equipment, so his students would have a better idea of what that equipment was like when actually seen in the field. The "threat" students also need to have a multidimensional representation of this equipment, and how it might appear in a battlefield array. Slides of individual pieces of Soviet equipment

under repair, as valuable as they may be for structural analysis, etc., do not convey the "feel" of the battlefield disposition of that equipment. It is noteworthy that the German Air Defense School (Ft. Bliss, TX) also created a field mock-up of Air Defense #-D Battlefield Systems using models, wood, plastic, etc. It was rather costly, but got extensive use and was considered "invaluable" by the local instructional staff.

The accuracy of the visual memory system can easily be documented. For example, Standing, Conezio, and Haber (1970) have shown that subjects can remember over 90% of complex visual scenes, even though the number to which they were originally exposed was over 2500. Further, the pictorial representations shown in the "threat" block are of isolated pieces of equipment, never of the complete battlefield disposition of potential enemy forces. In this regard, it should be noted that interactive visual images are particularly well remembered (Bower, 1970; Wollen, Weber, & Lowry, 1972). Although there has been some debate over exactly what the basis of these effects might be (Pylyshyn, 1973, for example), there can be no doubt about the efficacy of the visual experience. Visual experience is the source of visual memory events. While it may not be possible to obtain actual photographs of entire arrays, and it is certainly unlikely that firsthand visual images of actual battlefield dispositions will be made available to "threat" students, the following recommendation is offered as an alternative to provide the visual contextual reference that is now missing in the "threat" instruction:

> It would be useful for "threat" students to have a laboratory component in their instructional block. This laboratory would provide not only a visual encoding of some course information, but it would also provide an interactive/contextual frame of reference that is now missing. In essence it is as if they were now being told to play chess after only having read about the many moves possible. The laboratory exercises would consist of the active manipulation of realistic models of equipment, assigned to different Soviet organizational levels, for different terrains, in different defensive and offensive scenarios, etc. The students surveyed thought this would be quite useful. Having these "table top" laboratory exercises will help to establish the visual memory link between the verbal descriptions and physical reality that is not now being made.

The final recommendation is the most substantial, and will be dealt with at some length.

Given the short duration of this block of instruction and the large amount of information that must be learned, an upgrade to the instructional technology is appropriate and timely. The recommendations above will improve the students' mental representation and organization of the information, but much more can be done. A computerized tutorial package is recommended. Many universities have adopted variations of this approach for a variety of courses and they have met with some success. Improvement in long term retention in some studies (Kulik, Bangert, & Williams, 1983; Niemiec & Walberg, 1987) has been documented to be about 16%, and some have the added advantage of achieving accelerating learning rate through a self-paced, unit mastery learning approach. Further, in general, student and instructor attitudes towards computer assisted instruction are also positive (Kulik, et al., 1983; Halcomb, Chatfield, Stewart, Stokes, Cruse, & Weimer, in press). All of this would seem to be important for the "threat" block given the extensive amount of material to be covered and its very short duration.

Computer assisted instruction may be implemented in a variety of formats. There may be a complete computer controlled application in which the computer not only presents the information for study and tests, but in which the computer is used for tutorials as well as providing a complete course management system. Many permutations are also possible. Students may study from traditional texts, attend lectures, and use the computer only for testing or tutorials. Or, any one of these tasks may be relegated to the computer as best fits the needs of the course.

Any computer assistance application will be useful to the extent that the developers have considered the many factors that have been shown to determine the effectiveness of such systems. Among these factors are (1) aspects of the program that affect reading comprehension (Anderson, Anderson, Dalgaard, et al., 1975; Schloss, Schloss, & Cartwright, 1984, 1985), (2) the appropriate application of testing in the overall learning process (Foos & Fisher, 1988), (3) the nature of the feedback during the instructional phase (Gilman, 1969; Anderson et al., 1971; Cohen, 1985), and (4) the presentation of the feedback (Kulhavy & Anderson, 1972). There are other factors, but this list should make the point that the development of a successful computer assisted instruction application is not simply a matter of possessing programming skills, therefore, it must be purchased "commercially" rather than produced in-house.

The Self Test and Review (STAR) package, developed by Dr. Charles Halcomb and Associates at Texas Tech University (Halcomb et al., in press), has the advantage of having been developed, and is currently being used, in both an instructional and a research setting, so analysis and upgrading of the system is ongoing. It will be reviewed here as an example of a successful application.

17

STAR was designed as a study tool to be used with the course textbook and study guides. The basic goal of STAR is to focus on important concepts in the course and to provide knowledge feedback to the student so that they have a better idea of what they do and do not know. (Students are relatively poor assessors of their own comprehension level). Basically, STAR offers practice quizzes and final examinations, a guided review of chapter material and concepts, and graphic representations of student quiz performance. Procedurally, each student has their own copy of the STAR program which can run on any IBM compatible machine.

To document the effectiveness of the STAR program, a brief review of the latest evaluation study will be presented. This study is the doctoral dissertation project of Ms Barbara Stewart Chapparo (in preparation, 1989).

Forty-eight percent of the 1600 students enrolled in the Spring 1989 Introductory Psychology course opted to use the STAR program. (It is noteworthy that an introductory psychology course shares important characteristics with the "threat" block. There is a large amount of information contained in the course, and the students are essentially naive about the material). In assessing the effectiveness of STAR, students were ultimately divided into those who used it at high, medium, or low levels, or not at all. While STAR offers practice quizzes and detailed feedback about content areas for missed questions, it is not now being used as the examination of record. These are taken in an associated computer environment. The record of performance on these "quizzes that count" is presented in Figure 8. As is readily apparent, the more students used STAR, the greater the improvement in the quiz performance compared to that of the non-users. In addition, on the final examination (required of all students) the improvement was even greater, 16-, 17-, and 26-% improvement for low, medium, and high STAR users, respectively, compared to non-users. Thus, there may also be substantial long-term benefits as well.

Further, the course as a whole is self-paced, with students taking the examinations of record when they are ready for them. Among the STAR users, those who finished the course early had spent more time using STAR than those who did not. Some students can actually finish a semester course in just a few weeks. Overall, those who used STAR performed significantly better in the course than those who did not, and this was independent of the students' academic standing or grade point average. So, it was not just a matter of the better students using this new technology.

Another important aspect of the course structure is that of unit mastery. Students are permitted to take chapter quizzes as often as they wish until a self-defined level of mastery is achieved, with their grade being determined by the overall average they achieve. They take the quizzes when they are ready and then move on. It was noted in the 89-11 class survey data that those students would have
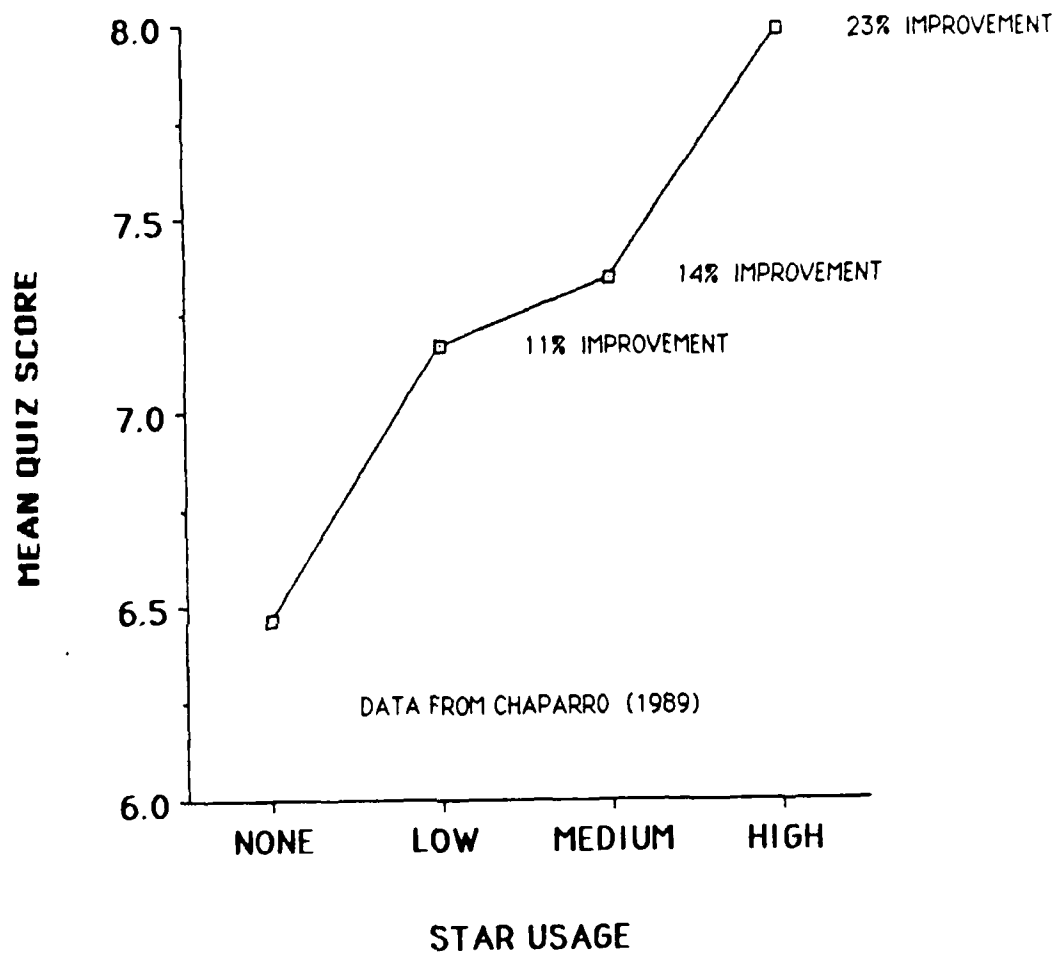
Figure 8. Percent course improvement (quiz scores) with STAR usage.

preferred that system as well. Therefore, the concept of self-paced unit mastery and the use of a computerized tutorial such as an adaptation of STAR might be incorporated in its entirety into the "threat" block of instruction. That would offer several important advantages:

1. Students would use STAR to guide their study through the course material, with STAR providing feedback and remedial advice on an <u>individual</u> student basis.

2. Students would be able to take the quizzes on a per CAE basis, and when they were prepared for them (although certain deadlines would have to be set).

3. STAR would provide an ongoing instruction and review capability during the evenings and weekends so students would not be "in limbo" during this valuable study time (assuming PC access during these times).

4. Students would be able to use STAR as a reviewing tool when they proceed to other blocks of OBC, and need to sharpen their "threat" skills.

5. STAR does not need complex computer equipment. As mentioned earlier, it will run on any IBM compatible machine. For what may be a very cost effective adaptation, several workstations could be made available in a relatively small space, and for comparatively little cost.

It is ironic that the multiple testing on dropped CAEs that now takes place is itself a crude analogue of the unit mastery system. What is recommended here is that this "naturally selected" process be systematically designed and incorporated into "threat" instruction. A very important point, however, is that while the usefulness of a tutor such as STAR may seem apparent, it should not be adopted until an appropriate study has been conducted to determine its effectiveness for an information dense, two week course such as "threat."

Finally, while "threat" is a vital part of the OBC curriculum, and the recommendations presented above are offered to improve the acquisition and retention of information in that block, it would seem that more data analysis is needed on the other blocks of the MIOBC course as well.

20

References

Anderson, T. H., Anderson, R. C., Dalgaard, B. R. et al. (1974). A computer-based study management system. Educational Psychologist, 11, 36-45.

Anderson, R. C., Kulhavy, R. W., & Andre, T. (1972). Conditions under which feedback facilitates learning from programmed lessons. Journal of Educational Psychology, 63, 186-188.

Bower, G. H. (1970). Organizational factors in memory. Cognitive Psychology, 1, 18-46.

Chapparo, B. S. (in preparation, 1989). An evaluation of S.T.A.R.: A computerized tutorial in general psychology. Doctoral dissertation, Texas Tech University.

Cohen, V. B. (1985). A reexamination of feedback in computer-based instruction: Implications for instruction design. Educational Technology, January, 33-37.

Foos, P. W., & Fisher, R. P. (1988). Using tests as learning opportunities. Journal of Educational Psychology, 80, 179-183.

Gilman, D. A. (1969). Comparison of several feedback methods for correcting errors by computer-assisted instruction. Journal of Educational Psychology, 60, 503-508.

Halcomb, C. G., Chatfield, D. C., Stewart, B. E., Stokes, M. T., Cruse, B. H., & Weimer, J. (in press). A computer-based instructional management system for general psychology. Teaching of Psychology.

Hall, J., & Knapp, B. G. (1983). A preliminary evaluation of "Think Red." (ARI Working Paper 83-03). Alexandria, VA: US Army Research Institute.

Kulhavy, R. W., & Anderson, R. C. (1972). Delay-retention effect with multiple-choice tests. Journal of Educational Psychology, 63, 505-512.

Kulik, J. A., Bangert, R. L., & Williams, G. W. (1983). Effects of computer-based teaching on secondary school students. Journal of Educational Psychology, 75, 19-26.

Niemiec, R., & Walberg, H. J. (1987). Comparative effects of computer-assisted instruction: A synthesis of reviews. Journal of Educational Computing Research, 3, 19-37.

Pylyshyn, Z. W. (1973). What the mind's eye tells the mind's brain: A critique of visual imagery. Psychological Bulletin, 80, 1-24.

Schloss, C. N., Schloss, P. J., & Cartwright, G. P. (1985).
Placement of questions and highlights as a variable influencing
the effectiveness of computer assisted instruction. _Journal of_
Computer-Based Instruction, _12_, 97-100.

Standing, L., Conezio, J., & Haber, R. N. (1970). Perception and
memory for pictures: Single trial learning of 2560 visual
stimuli. _Psychonomics Science_, _19_, 73-74.

Wollen, K. A., Weber, A., & Lowry, D. H. (1972). Bizarreness versus
interaction of mental images as determinants of learning.
Cognitive Psychology, _3_, 518-523.